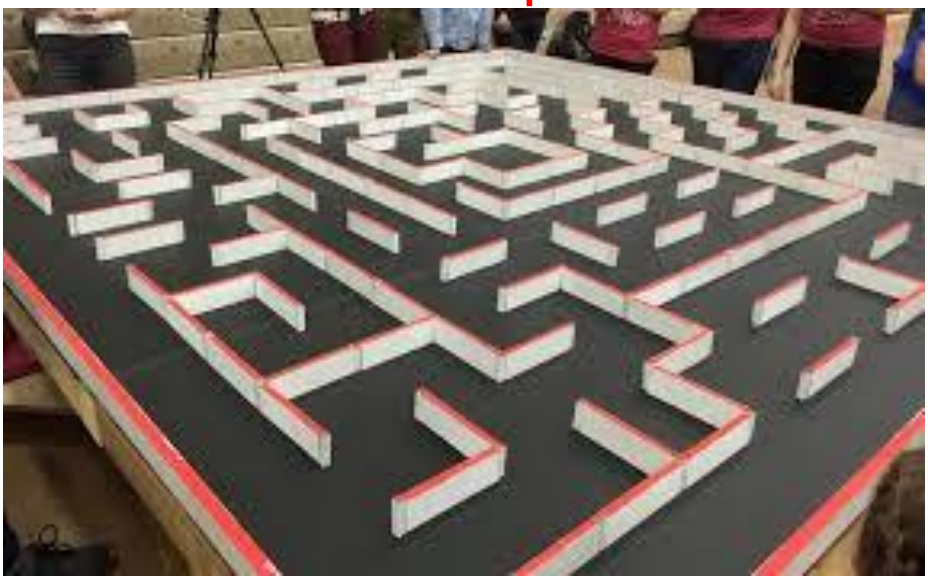
# Micromouse Competition



## Objective

Small teams of students will design and build an autonomous, self-contained robot that can traverse a previously unknown maze from a specified corner to the center in the least amount of time possible.

## Rules for the Micromouse (Robot)

1. The robot should be completely autonomous (self-contained). Once it begins running, it should not receive any outside signals.
2. The robot cannot be powered by any combustion-based energy source.
3. The robot cannot damage the maze in any way.
4. The robot cannot climb, jump, or fly over the maze walls.
5. The robot must be smaller in length, width, and height, than 20 centimeters. The dimensions of a robot that changes its geometry during a run cannot exceed the dimensions: 20cm x 20cm x 20cm.
6. The cost will be a factor in evaluating the robot's design.

## Rules for the Maze

1. The maze is composed of 25*25 cm unit squares, not including the thickness of the walls. The maze comprises 8*8 of these unit squares. The walls of the maze are 5 cm high and 1.2 cm thick (assume 5% tolerance for mazes). The outside wall encloses the entire maze.
2. Small square zones (posts), each 1.2 cm x 1.2 cm, at the four corners of each unit square are called lattice points. The maze will be constructed so that there is at least one wall at each lattice point.
3. The sides of the maze walls are white, the tops of the walls are red, and the floor is black. The maze is made of wood, finished with non-gloss paint.
a. **WARNING:** Do not assume the walls are consistently white, or that the tops of the walls are consistently red, or that the floor is consistently black. Fading may occur; parts from different mazes may be used. Do not assume the floor provides a given amount of friction. It is simply painted plywood and may be quite slick. The maze floor may be constructed using multiple

sheets of plywood. Therefore there may be a seam between the two sheets on which any low-hanging parts of a robot may snag. There may be tape (such as electrical tape) covering some of the seams.
4. The start of the maze is located at one of the four corners. The start square is bounded on three sides by walls. The starting square orientation shall be such that when the open wall is to the “north,” outside maze walls are on the “west” and “south.” The start line is located between the first and second squares. That is, as the robot exits the corner square, the time starts. The destination goal is the four cells at the center of the maze. The destination square has only one entrance.
5. Multiple paths to the destination square are allowed and are to be expected. The destination square will be positioned so that a wall-hugging mouse will NOT be able to find it.

## Rules for the Maze Solving Competition

1. Robots must be checked in prior to contestants seeing the competition maze in order to avoid hard-programming information. Prior to check-in, contestants may run the robot in the maze area to calibrate environmental conditions, and may ask for a non-start corner of the maze to be uncovered for a brief test. Check-in will end at the time designated by the competition coordinators, after which robots will be inaccessible until the time of competition.
2. Each contesting robot is allocated a total of 12 minutes of access to the maze from the moment the contest administrator acknowledges the contestant(s) and grants access to the maze. Any time used to adjust a robot between runs is included in the 12 minutes. Each run (from the start cell to the center zone) in which a robot successfully reaches the destination square is given a run time. The minimum run time shall be the robot’s official time. First prize goes to the robot with the shortest official time. Second prize to the next shortest, and so on.
a. **NOTE:** that the 12 minute timer continues even between runs.
3. Robots that do not enter the center square will be ranked by the maximum number of **unique** cells they consecutively transverse without being touched. All robots who enter the center square within their 12 minute allotment are ranked higher than those who do not enter the center square.
4. Each run shall be made from the starting square. The operator may abort a run at any time. If an operator touches the robot during a run, it is deemed aborted, and the robot must be removed from the maze and replaced in the starting square. If the run is aborted, a 20 second penalty is added to the next run’s time.
5. If a robot has already crossed the finish line, it may be removed at any time without affecting the run time of that run.
6. After the maze is disclosed, the operator shall not feed information into the robot. (See rule 14 for exceptions to this rule).
7. The illumination, temperature, and humidity of the room shall be those of an ambient environment. (40 to 120 degrees F, 0% to 95% humidity, non-condensing).
a. **BEWARE** : Do not make any assumptions about the amount of sunlight, incandescent light, fluorescent light, or infrared that may be present at the contest site.
8. The run timer will start when the front edge of the robot crosses the start line and stops when the front edge of the robot crosses the finish line. The start line is at the boundary between the starting unit square and the next unit square clockwise. The finish line is at the entrance to the destination square.
9. Every time the robot leaves the start square, a new run begins. If the robot has not entered the destination square, the previous run is aborted. For example, if a

robot reenters the start square (before entering the destination square) on a run, that run is aborted, and a new run will be deemed begun, with a new time that starts when the starting square is exited.
10. The robot may, after reaching the destination square, continue to navigate the maze, for as long as their total maze time allows.
11. If a robot continues to navigate the maze after reaching the destination square, the time taken will not count toward any run. Of course, the 12 minute timer continues to run. When the robot next leaves the start square, a new run will start. Thus, a robot may and should make several runs without being touched by the operator. It should make its own way back to the beginning to do so.
12. The judges reserve the right to ask the operator for an explanation of the robot. The judges also reserve the right to stop a run, declare disqualification, or give instructions as appropriate (e.g., if the structure of the maze is jeopardized by continuing operation of the robot).
13. A contestant may not feed information on the maze to the robot. Therefore, changing ROMs or downloading programs is NOT allowed once the maze is revealed. However, contestants are allowed to:
a. Replace batteries between runs
b. Adjust sensors
c. Change speed settings
d. Make repairs. A repair cannot change the robots design.
14. However, a contestant may not alter a robot in a manner that alters its weight (e.g. removal of a bulky sensor array or switching to lighter batteries to get better speed after mapping the maze is not allowed). The judges shall arbitrate.
15. All robots, whether or not they have competed in previous contests, compete on an equal basis. All robots must be presented to the judges by the original design team, which must meet all other qualifications. First prize will go to that robot which travels from the start square to the destination square in the least amount of time. Second and third prizes will be awarded to the second and third fastest respectively. As stated in Rule 2 above, robots that do not enter the center square will be ranked by the maximum number of cells they consecutively transverse without being touched.
**16. The decision of the Judges shall be treated as final and binding at all times.**

# Simulator

A virtual machine for the simulator has been developed, and it can be run using VirtualBox. This is the easiest way to get started. The virtual machine is available here. The simulator can be launched with the desktop shortcut named “mms”.
If the simulator runs slowly on the virtual machine, participants can also install the simulator on their own machines. However, they must ensure their programs work on the virtual machine before submitting. To install the simulator, first clone or download this repository and then follow the instructions in the readme.

## Sample Mazes

Three sample mazes are available here for download. The competition mazes will resemble the characteristics of these sample mazes and will have a similar number of walls.

## Rules for the Design Competition

1. Each team will give a short Design Presentation. This is separate from the main competition. The team with the best presentation wins an award for design.
2. The winner of the Design Competition can also be the winner of the Maze Solving Competition portion of the competition, though they are evaluated separately and on different criteria.
3. The presentation should be at most eight minutes in length. After the presentation, there will be a three minute "Question and Answer" session with the judges. Judges will have a point rubric to score each presentation, and a team's final score is the average of their scores from each judge.
4. In the event of a tie, the judges will gather privately and decide the winner based on the design and design presentation of the tied teams.
5. The panel of judges will be comprised of **birzeit** University faculty, staff, and/or graduate students, all of whom have experience either in robotics or a relevant field.
6. The winner of the Design Competition can also be the winner of the Maze Solving portion of the competition, though they are evaluated independently and on differing criteria.
7. There is no dress code for the presentations or the competition.
8. Design of the robot includes (but is not necessarily limited to): mechanical design, algorithmic design, and electrical design.
9. Recommended topics to be included in the Design Presentation:

a. Cost-efficiency of the robot, shown by a parts list.
b. The team's general approach to solving the maze within the constraints of the competition.
c. Performance of the robot (i.e. how well the robot traverses the maze).
d. Individually: mechanical, algorithmic, and electrical design choices made.
e. Areas of improvement or future design goals.